

most of the meteors was blue, or the colour of electric light. A number of the meteors curved suddenly round just before disappearing. Numbers of meteors were seen dropping into black clouds, others seen dropping out of them down to the horizon.

Mossvale, Paisley, January 14

DONALD CAMERON

BRITISH APHIDES¹

ENTOMOLOGISTS are fond of attaching themselves to some special group of insects—bees, beetles, or butterflies; but there are very few, we believe, who take an interest in collecting the winged or wingless forms of the Aphides. One is very apt to overlook the value of the work of a mere collector, but it comes home to us when amid a group so large, and so important from an economic point of view, as this of the plant lice is, we find only some half a dozen of our British naturalists collecting specimens of the species or making observations on the marvellously strange habits of their heterogeneous forms. Under these circumstances it was most fortunate that a society like the Ray Society was in existence, for the number of those interested in the subject of the history of British Aphides would have been too miserably small to have justified any publisher, no matter how energetic, from publishing an account of these insects; but, thanks to the Ray Society, we have, as the works published by them for their subscribers for the years 1875, 1877, 1880, and 1883, four handsome octavo volumes by Mr. G. Bowdler Buckton, F.R.S., which seem well entitled to their designation of a "Monograph of the British Aphides." These volumes, besides the text, contain over 140 plates, of which ten are devoted to anatomical details, and the rest to coloured portraits of the species both in their immature and various mature forms, and in some few instances there are representations of the various parasites which feed on them. It is to be specially noted that these figures are both drawn and lithographed by the author, and certainly a more interesting series of life-like figures of Aphides is nowhere to be found.

While it seems true that the Aphides are not general favourites of the collector, it is also true that no group of insects has attracted more attention. For nearly a century and a half the mysteries of their growth and development have been laboriously inquired into, and the researches of Réaumur and Charles Bonnet in the eighteenth, and those of Huxley in this our nineteenth century, have not exhausted all the marvels of these strange forms. Their history makes them in many ways attractive. Thus, to those interested in the details of embryology, these Aphides present questions for solution of the greatest importance, and concerning which there is still no absolutely settled opinion. Even the brilliant investigations as to this branch of the subject by Huxley still left work to be done. To the general naturalist they present a source for abundant study—not only their varied and often strange forms, but their curious habitations and the defences which they seem to have against hosts of different insect foes; while to the practical economist they have an immense interest when he thinks that by their success in the struggle for life they cause distress to human nations, often bringing about decrease in the amount of our food material and an increase in the amount of our taxation. To name the Hop Fly or the Vine Aphis is to at once illustrate our meaning.

It is not our intention to write a criticism on Mr. Buckton's learned monograph; it pleases us better to introduce it to our readers as a scientific work full of many easily read and wonderful histories of our native species of plant lice—one that the reader will not lay down in a hurry when he once takes it up; one in which, open where he will, he shall find something in it to interest and attract him. In order that we may in some measure

prove this we will give a brief sketch of the chief subject-matter of these volumes. Passing over the disquisition as to the origin and meaning of the word "aphis," we have a general history of the group; included under this heading we find a sketch of their anatomy, an account of the most noteworthy contributions to their history by the early writers, and a sketch of what is known as to their metamorphoses and their very strange reproduction. This is followed by the classificatory portion, in which full diagnoses are given of the genera and species.

Mr. Buckton would account for the want of activity in our entomologists in their study of this group by the confusion into which the group has fallen with reference to its synonymy. One species of Aphis possesses no less than thirty synonyms, while in another case the same name has been given to no less than six different species of the group. There is this further difficulty in their study, that the distinctive characters are far less marked than in most other insects. As to colour, not only are the young sometimes in this respect quite unlike their parents, but their hues vary with the hour, and even the adult forms may undergo as great a change in their tints as the autumn leaves amongst which they nestle.

The family itself belongs to the order of the Hemiptera and to the sub-order Homoptera, where it is located between the families Coccidæ and Psyllidæ. Among the anatomical peculiarities it may be noted that the winged forms are provided with no less than three different kinds of eyes—ocelli, compound eyes, and supplementary eyes. The larvæ of some have eyes; in others the eyes are quite rudimentary; while in some subterranean forms they are absent. Though all the winged forms have ocelli, yet their nocturnal habits are not marked. All the Aphides are suctorial in their habits; as the source of their food varies so does the structure of the mouth parts, especially the rostrum and setæ. In *Stomaphis quercis*, feeding in the alburnum of the oak, the rostrum is nearly twice the length of the insect, and the setæ are much longer; and in the genera *Lachnus* and *Schizoneura*, in the young forms, the rostrum projects beyond the end of the abdomen, and is carried as if it were the tail of the insect; while in the young of *Chermes laricis* the long and delicate setæ are coiled into a spiral, which would seem to act as a kind of spring cable by which the insect moors itself so to its feeding ground that it is not easily dislodged by the rough winds of early spring as they play among the larch branches. The punctures are not made by the rostrum, which seems only to act as a sheath, but by the setæ, which can be seen to lance open a number of the parenchymatous cells, and so cause a plentiful flow of cell-contents.

On the question as to the function of the cornicles, the author does not agree with Kalténbach that they are organs connected with the respiratory apparatus, but rather regards them as the external terminations of excretory ducts. As to honey-dew, the remarks of Kirby and Spence, ascribing it to a secretion of Aphides, is accepted as true by almost all who have written on the subject—including the author—though others, among whom may be mentioned Liebig, Sir J. Hooker (1873), Boussingault (1872), still combat this view.

The chapter on the bibliography begins by alluding to the work of the celebrated anatomist and philosophical lens grinder, Leuwenhoek, in 1690, glances at that of Réaumur (1737), Charles Bonnet (1779), De Geer (1778); the more modern writings of Schrank, Hausmann, Burmeister, Harting, Kalténbach, Kyber, Morren, Leuckart, von Siebold, Ratzeburg, and Koch among the Germans; Passerini among the Italians; Signoret, Balbiani and Claparède among the French writers; Newport, F. Walker, Haliday, and Huxley among the English writers on the subject.

Aphides are to be found almost everywhere throughout Britain. Some are hardy enough to thrive on the stony

¹ "Monograph of the British Aphides." By George Bowdler Buckton, F.R.S., &c. Four volumes; being the volumes issued by the Ray Society of London to their subscribers for the years 1875, 1877, 1880 and 1883.

heaths of Scotland and Northumberland, whilst others will live almost in the reach of the spray on the seashore; terrestrial and aquatic plants are alike subject to their attacks. Some feed on succulent herbs, others on hard timber trees; others again on the roots of flowering plants. Sometimes the white water lily (*Nymphaea alba*) is almost destroyed by the myriads of *Rhopalosiphum nymphaea* which crowd on its leaves and flowers. While certain trees and shrubs appear to be attacked exclusively by their own peculiar Aphis, other trees give nourishment indiscriminately to numerous species. Thus the oak is attacked by at least six, the willow and birch by eight, and the conifers by the same number. Some families of plants are free or almost free from them, such as the Gentian and Irid families. But one species of the large group of the ferns is as yet known to be attacked by them; indeed the cryptogams are as a general rule very free from Aphides; but we have known a species of *Marsilea* to swarm with them.

The migration of the Aphides is still involved in some mystery, and we seem to have as yet no certain knowledge of the winter habitats of numerous species which seem to occur only during a few weeks of midsummer, such as *Siphonophora millefolii*, which may be found from July to September, and then entirely eludes our notice for the rest of the year.

The peculiar habits of the species opens an immensely interesting subject: some are almost sedentary, others are fairly active; some form receptacles which strangely mimic fruits; some if disturbed dropt to the ground, others run to the opposite side of a leaf or twig; some throw up their hind legs when alarmed, which action gives a signal to the rest of the colony, which responds by going through the same performance; some assimilate their colours to their food plants, so as to be difficult to perceive. An interesting phenomenon in connection with these insects is their dimorphism. Thus the early spring form of *Chermes laricis* is different from that of all her progeny till the last, and the same is the case with *Aphis mali*. These variations often relate to size and colour, but often also to considerable change in form and modification of parts. The most extraordinary instance occurs in *Chaitophorus aceris*, "the early spring forms of which occasionally are so diverse that they have been described as belonging to not only different genera but even to distinct families. Thus Mr. Thornton, the original discoverer of this strange insect, gives it the name of *Phyllophorus testudinatus*; afterwards Mr. L. Clark called it *Chelymophora testudo*, placing it between the Aphididae and the Coccidae." But a nearly equally striking example occurs in the dreaded *Phylloxera vitis*, which has two entirely different habits of life and form. In one it is active and winged; in the other it is apterous and subterranean.

We would have liked more ample information as to the geographical distribution of the group. We read that "it is confined to the more temperate regions of the globe," and "that as we approach the tropics it appears to give way to such forms as *Coccus*." Over the whole continent of Europe they are spread, and across Europe into the Amur district of China. They abound in North America; seem not to be indigenous in New Zealand, though in this country, according to Prof. Hutton, imported species were often very destructive to the crops; and nothing is said as to their occurrence in Australia or the Cape of Good Hope district.

Mr. Buckton divides the family into four sub-families: Aphidinae, Schizoneurinae, Pemphaginae, and Chermesinae.

Volume i. is taken up with an account of the first half-dozen genera of the first sub-family, and is illustrated with three plates of anatomical details, and forty-two coloured plates of species. Among the more familiar species whose life-histories are given are the Rose Aphis (*Siphonophora rosea*), the Wheat Aphis (*S. granaria*),

the destructive Hop Fly (*Phorodon humuli*), the Cherry Aphis (*Myzus cerasi*), and the Peach Aphis (*M. persica*), this last one of the most beautifully coloured of our native species.

Volume ii., with forty-eight plates, concludes the descriptive details of the genera and species of the sub-family Aphidinae with seven-jointed antennae, including the type-genus Aphis. Full details are given of that troublesome insect *Rhopalosiphum dianthe*, the *Aphis vastator* of Smee, which feeds on almost every cultivated plant, often swarming on the potato, turnips, pinks, not to mention hyacinths, tulips, and oleanders, but which the author agrees has nothing to do with the production of either the potato disease or clubbing in crucifers. Forty-five species of the genus Aphis are enumerated, and a very useful analytical table of these is appended. No less than seven synonyms are quoted to *A. rumicis*, Lin., which commits such destruction often on the bean and turnip crop, and which is not very particular as to its food plants. Seven species of the genus Chaitophorus are described, and a full account is given of the very extraordinary dimorphism existing in *C. aceris*. In this volume we have accounts of the aphidivorous Hemerobiidae and Hymenoptera.

Volume iii., with twenty-seven plates, contains the description of the forms of the sub-family Aphidinae with six-jointed antennae, of the sub-family Schizoneurinae, and of some of the forms of the sub-family Pemphaginae. Among the more familiar species we have here the Aphis (*Pterocallis tiliae*) which abounds on the lime tree, and so bedews it with its sweet secretion; the Beech Aphis (*Phyllaphis fagi*), so well known as often covering the leaves of the beech tree with its white cottony or rather waxy fluff; the Sallow Aphis (*Lachnus viminalis*), which sometimes swarms on our willows. The "American blight" (*Schizoneura lanigera*) on our apple trees is an introduced species, apparently from America. It appears that they descend into the soil in winter and attack the roots of the apple trees. *S. lanuginosa* is the aphid which produces the wonderful fig-like galls on the elm tree. These galls are about the size of small green figs, with a small opening at their summits; they contain thousands of the plant lice. In 1866 Mr. McLachlan, travelling in the south of France, gathered a number of these galls, which were in extreme profusion—elm trees twenty feet high being one mass of galls—with the intention of bringing them home; but they made such an awful mess from the viscid liquid in the galls, that he was compelled at last to throw them away. *Pemphigus lactucarius* is the species found living in little earth cavities in the vicinity of the roots of various plants. If a stump of lettuce be pulled up in spring, these "downy flocks" will be very often detected.

The last volume, with twenty-four plates, concludes the account of the species of Pemphaginae, and gives descriptions of those of the sub-families Chermesinae and Rhizobiinae. Mr. Buckton agrees with Passerini, and retains Chermes among the Aphididae. The Greek verse on the title-page of this volume having caught our eye, we are reminded how little the families treated of in it are the subjects of parasitism; the reason why seems obscure: with these forms the big and little fleas seem to lie down together, not causing each the other any alarm. The Fir Aphis (*Chermes abietis*) is the maker of the curious cone-like galls of the spruce, and a closely related species is often very destructive to larch plantations. Of the genus Phylloxera two native species are described, and a full account of the Vine Aphis (*P. vitis*) now introduced into our hothouses is also given. In this account we have a very interesting and important communication from that eminent entomologist, Jules Lichtenstein, in which he gives a summary of his views on the metamorphoses of the plant lice. This volume has appended to it chapters on Aphides in their economical relations to ants; on the reproduc-

tion of Aphides; on the biology and morphology of Aphides; on the antiquity of the Hemiptera, and particularly with regard to the Aphidinae as represented in the sedimentary rocks and in amber; diagnoses of the Aphides found in amber are given, with figures; and we have also an account of those known to occur in a fossil state in America. Directions for the mounting and preservation of Aphides are given, and we find a very complete bibliography of authors who have treated about Aphides, and a very excellent general index.

In conclusion it only remains for us to congratulate the author on the very successful accomplishment of this important work, which is certain to excite an interest in this marvellous group of insects, and the Ray Society on being the medium of publishing the most beautifully illustrated work on the Aphides that has as yet appeared.

EARTHQUAKES AND BUILDINGS

A COMPLETE discussion of the effects which earthquakes produce upon buildings would form a treatise as useful as it would be interesting. Not only would it involve a discussion of the practical lessons to be derived from the actual effects of earthquakes, but it would include deductions based on our present knowledge of the nature of earthquake motion. Such knowledge is obtained from the records of seismographs.

In the following few notes I intentionally overlook this latter portion of the subject, and confine myself to a few of the more important practical conclusions respecting the effect of earthquakes on buildings, which may be of value to those whose mission it is to erect buildings in earthquake countries.

With regard to the situation of a building, it is sometimes observed that after an earthquake it is the portion of a town situated on low ground which has principally suffered, whilst adjoining portions on hills may have practically withstood the disturbance. In 1855 this was the rule governing the distribution of ruin in Tokio. The reverse, however, has been the rule in Yokohama. Speaking generally on this point it may be said that there is no universal rule,—each small area in an earthquake region having its special rule. As a site for a building, theory seems to indicate that soft earth or marshy ground, which would absorb much of the momentum communicated to it, and therefore act as a buffer between a building and a shock approaching through other strata, would prove a safe foundation. This seems also to have been an old opinion, for we read that the temple of Diana was built on the edge of a marsh to ward off the effects of earthquakes, but experience has repeatedly shown us, as in the case of Tokio and Manila, that swamp-like ground, as an earthquake palliative, has but little effect. On the other hand, hard rocky strata, where the amplitude of motion is small, but the period quick as compared with the motion in the inelastic material of the plains, has, as was markedly illustrated in 1755 at Lisbon, and in 1692 at Jamaica, proved the better foundation. Places to be avoided are the edges of cliffs, scarps, and cuttings. For emergent waves, these are free surfaces, and from their faces materials are invariably shot off, much in the same way that the last car in an uncoupled train of carriages may be shot forward by an engine bumping at the opposite end.

As foundations for a building there are two types. In one, which is the European method of building, the structure is firmly attached to the ground by beds of concrete, brick, and stone. In the other, which is illustrated in the Japanese system of building, the structure rests loosely on the upper surface of stones or boulders. As an indication of the relative value of these two forms of building, it may be mentioned that in Yokohama, in 1880, many of the European buildings were more or less

shattered, whilst in the Japanese portion of the town there was no evidence of disturbance.

The houses, like the foundations, are also of two types. In the European house built to withstand earthquakes, of which there are examples in Tokio and San Francisco, and for which in America patents have been granted, we have a building of brick and cement bound together with hoop iron and numerous tie rods. A building like this, which from time to time is jerked backwards and forwards by the moving earth, to which it is secured by the firmest of foundations, is expected to resist the suddenly-applied and varying stresses to which it is exposed by the strength of its parts. This type of structure may be compared to a steel box, and if its construction involves any principle, we should call it that of strength opposing strength. Some of the buildings in Caraccas, which are low, slightly pyramidal, have flat roofs, and which are bound along their faces with iron, belong to this order. These so-called earthquake-proof buildings, with the exception of their chimneys, have certainly satisfactorily withstood small earthquakes in Japan. As to how they would withstand a disturbance like that at Casamicciola is yet problematical. Unfortunately these structures are very expensive.

The second type of building may be compared to a wicker basket. This is certainly as difficult to shake asunder as the steel box type, and at the same time is not so expensive. The Japanese house belongs to this type. It is largely used on the west coast of South America; and in Manila, since the disaster of 1880, it has rapidly been replacing the heavy stone form of structure. Briefly, it is a frame house with a light roof of shingle, felt, or iron. As put up in Japan, its stability chiefly appears to depend on the fact that it is *not* firmly attached to the earth on which it rests, and that its numerous joints admit of considerable yielding. The consequence is that, whilst the ground is rapidly moving backwards and forwards, the main portions of the building, by their inertia and the viscous yielding of their joints, remain comparatively at rest.

A house that my experience suggests as being aseismic, and at the same time cheap, would be a low frame building, with iron roof and chimneys supported by a number of slightly concave surfaces resting on segments of stone or metal spheres, these latter being in connection with the ground. Earthquake lamps, which are extinguished on being overturned, would lessen the risk of fire, while strong tables and bedsteads would form a refuge in case of sudden disturbances.

In earthquake towns the streets ought to be wide, and open spaces should be left, so that the inhabitants might readily find a refuge from falling buildings. Brick chimneys running through a wooden building, unless they have considerable play and are free from the various portions of the building, are exceedingly dangerous. In consequence of the vibrational period of the house not coinciding with that of the chimney, the former by its sudden contact with the latter when in an opposite phase of motion almost invariably causes an overthrow. In 1880 nearly every chimney in the foreign settlement in Yokohama was overthrown in this manner, and the first alarm inside the houses was created by a shower of bricks falling on beds and tables. Since this occurrence the chimneys in Yokohama have had more or less play given to them where they pass through the roofs.

Chimneys with heavy tops, like heavy roofs, must be avoided. Another point requiring attention is the pitch of a roof. If this is too great, tiles or slates will be readily shot off. Archways over openings should curve into their abutments, otherwise, if they meet them at an angle, fractures are likely to be produced.

If for architectural reasons, or as a precaution against fire, it is necessary to have buildings which are substantial, their upper portions ought to be as light as is